AVIATION IN THE UNITED STATES NAVY

THIRD EDITION

NAVAL HISTORY DIVISION, WASHINGTON, D.C.

SOME DEVELOPMENTS OF U.S. NAVAL AVIATION—FIRST FIFTEEN YEARS

July 2, 1911—Lt. Ellyson, U.S. Naval Aviator No. 1, qualified for his aviation pilots license. Since then over 85,000 have earned the right to wear the coveted "wings".

October 6, 1912—Lt. Towers flying the A-2 remained airborne 6 hrs., 10 mins., 35 sec., establishing a new American endurance record for flight in any type of machine.

June 13, 1913—Lt. Bellinger flying the A-3, set an American altitude record for seaplanes reaching 6,200 feet over Annapolis.

November 10, 1917—A Navy "flying bomb" built by Curtiss Company, was delivered to Sperry Flying Field at Copiaque, Long Island, for test. This was forerunner of today's guided missiles.

November 11, 1918—During 19 months of participation in World War I, Naval Aviation personnel increased from 287 to 39,871; aircraft increased from 54 to 2,107. Aircraft logged over 3 million nautical miles on patrol and attacked 25 German submarines; sinking or damaging 12.

May 27, 1919—At 8:01 p.m. NC-4 landed in the harbor at Lisbon, Portugal, completing the first crossing of the Atlantic by air.

July 6, 1920—In a test of the radio compass as an aid to navigation, a F5L left Hampton Roads and flew directly to USS OHIO, 94 miles at sea in a position unknown to the pilot. Without landing the plane returned to shore, this time navigating by signals from Norfolk.

March 20, 1922—The first U.S. Navy aircraft carrier USS LANGLEY commissioned. The ship was of 11,500 tons with a flight deck 534′ x 64′.

September 28, 1923—Lt. Rittenhouse, flying a CR-3 seaplane, won the Schneider Cup at Cowes, England, setting a world speed record of 169.89 mph.

May 9, 1926—LCdr Byrd and NAP Bennett made the first flight over the North Pole, reaching it at 4:30 a.m. in a trimotor Fokker. After circling, they returned to Kings Bay, Spitzbergen, completing 15 hr. trip.

THE RECENT YEARS

September 29, 1946—The TRUCULENT TURTLE, a Lockheed P2V Neptune piloted by Cdr Davies, took off from Perth, Australia beginning a non-stop, non-refueling flight reaching almost halfway around the globe. On 1 October, 55 hrs. and 17 mins. later, the plane landed at Columbus, Ohio, establishing a world distance record of 11,235.6 miles that stood for sixteen years.

September 6, 1947—A V-2 rocket was launched from the flight deck of USS MIDWAY. This was the first firing of a large rocket from a ship at sea.

October 31, 1956—VX6-Skytrain, first aircraft ever to land at the South Pole, arrived with RAdm G. F. Dufek, CTF-43 and Capt D. Cordiner, CO VX6 aboard. Flight from and return to McMurdo Sound called for perfect navigation. LCdr Conrad Shinn, was the pilot.

September 3, 1952—Naval Ordnance Test Station, Inyokern, fired the first fully configured SIDEWINDER air-to-air missile. In 1958 SIDEWINDER became the first missile to destroy aircraft in combat; being employed by the Chinese Nationalist Air Force.

August 21, 1956—An F-8A Crusader, piloted by Cdr Windsor, captured the Thompson Trophy with a speed of 1015.428 mph. With full armament of 20 mm cannon and ammo it was the first operationally equipped jet fighter to fly faster than 1,000 mph.

April 9, 1959—Four Naval Aviators, LtCol Glenn, USMC, LCdr Schirra, LCdr Shepard and Lt. Carpenter were among seven men selected as prospective astronauts under Project MERCURY—a basic program in the development of space exploration and manned orbital flight.

September 25, 1960—An F-4B piloted by Cdr Davis, averaged 1390.21 mph for 100 kilometers over a closed course, bettering the existing world record by more than 200 mph. On December 26, 1959 this type plane, piloted by Cdr Flint, flew to a world record altitude of 98,560 feet.

1962—A record breaking year. NAVAL AVIATORS set *twelve* world records including the helicopter speed record of 210.65 mph.

June 8, 1963—Naval Aviation Museum opened at Pensacola.

October 1, 1963—Two Navy C-130 Hercules aircraft landed at McMurdo Station, Antarctica, completing the first flight from Capetown, South Africa, a distance of 4700 miles. The flight forged a new link with the Antarctic continent and officially inaugurated Deep Freeze '64.

October 3, 1964—TASK FORCE ONE, composed of three nuclear powered ships, USS ENTERPRISE (with CVW-6 embarked), USS LONG BEACH, and USS BAINBRIDGE, completed "Sea Orbit" around the world cruise in sixty-five days without logistic support.

December 2, 1965—The first combat by a nuclear-powered major warship when CVW-9 aircraft were launched from USS ENTERPRISE against Viet Cong objectives. A record of 13,020 combat sorties were flown during 130 days on the line.

December 15, 1966—Admiral John H. Towers, Naval Aviator No. 3, was posthumously honored by enshrinement in the National Aviation Hall of Fame at Dayton, Ohio.

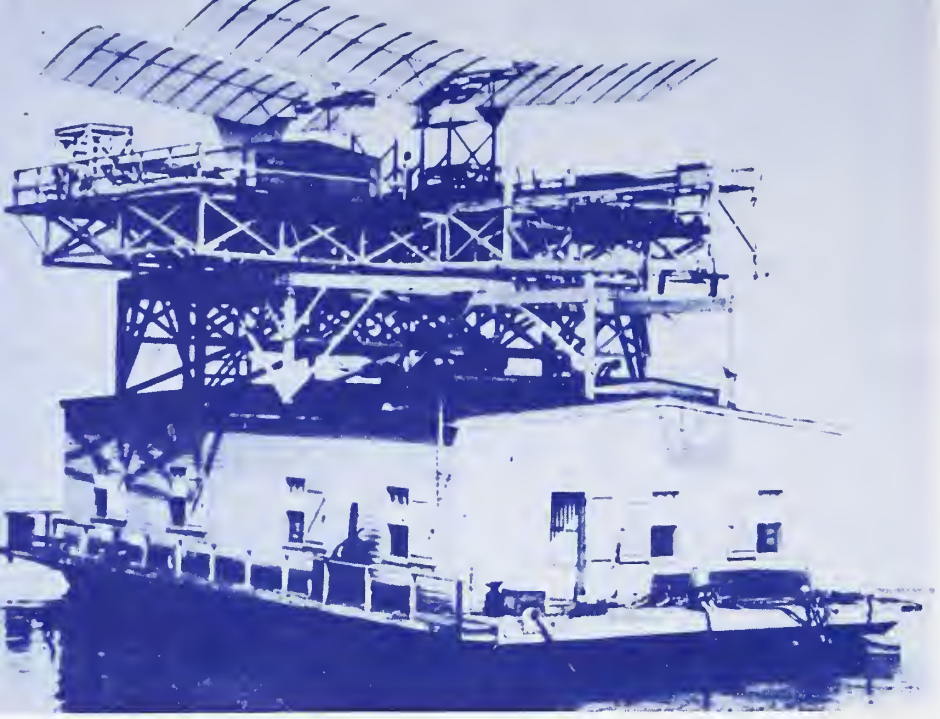
1967—In a typical month, Navy planes deliver more than 5,000 tons of bombs and almost 30,000 rockets in strikes against targets in North and South Viet Nam.

Aviation has brought vast changes to man's life, changes that still unfold and expand into space infinitely. One of its effects has been to make sea-based power more significant and influential than ever in the shaping of the fate of nations. Like many of the revolutions affecting our times, naval aviation can trace some of its origins to the Civil War. On 4 August 1861, John La Mountain ascended in a balloon moored to the deck of the Union transport FANNY to observe Confederate positions; thus began sea-based aerial reconnaissance. These operations from the water proved highly valuable for Federal military movement and for a considerable time were used most successfully. Particularly valuable were a number of ascents by Thaddius Lowe from an especially constructed balloon carrier, GEORGE WASHINGTON PARKE CUSTIS. Thus originated the far off beginnings of the wide-ranging, hard hitting carrier task forces that crushed Japan in World War II and that are the strength of the Free Worlds' "Confederacy of the Sea" in the second half of the Twentieth Century.

The balloon boat GEORGE WASHINGTON PARKE CUSTIS of Civil War days. Some have called her "The first aircraft carrier."

Several of the many revolutions that changed navies last century, such as the internal combustion engine, combined to make possible at about the same time at the end of the century both an effective submarine and a practical airplane. Thus navies began to go under the sea and into the air to gain new dimensions and potentialities unlimited.

In 1898 seeing the possibilities for sea power inherent in aviation and aroused by the success of Professor Langley's flying machine, the farsighted Assistant Secretary of the Navy, Theodore Roosevelt, recommended to the Secretary of the Navy that an inter-service board be established to determine the military value of the airplane in the event of war. This joint board was appointed and reported favorable interest in further experimentation in the use of the airplane as a military weapon. In the years that followed, many naval observers attended air meets and public demonstrations by the Wright Brothers. All were enthusiastic about the possible use of the airplane as a fleet scout.



Professor Samuel P. Langley's flying machine.

Theodore Roosevelt's letter recommending investigation of Langley's machine.

THEODORE ROOSEVELT,
ASST. SECRETARY.

NAVY DEPARTMENT,

WASHINGTON,

March 25, 1898.

Sir:

Mr. Walcott, Director of the Geological Survey, hae just been in to sse me, having seen the President. He hae shown me some interesting photographe of Professor Langley's flying machins. The machine hae worksd. It seems to me worth while for this government to try whether it will not work on a large enough ecale to be of use in the evsnt of war. For thie purpoee I recommend that you appoint two officers of scientific attainments and practical ability, who in conjunction with two officers appointed by the Secretary of War, shall meet and examine into this flying machine, to inform ue whether or not they think it could beduplicated on a large scale, to make recommendation as to its practicability and prepars eetimates as to the cost.

I think this is well worth doing.

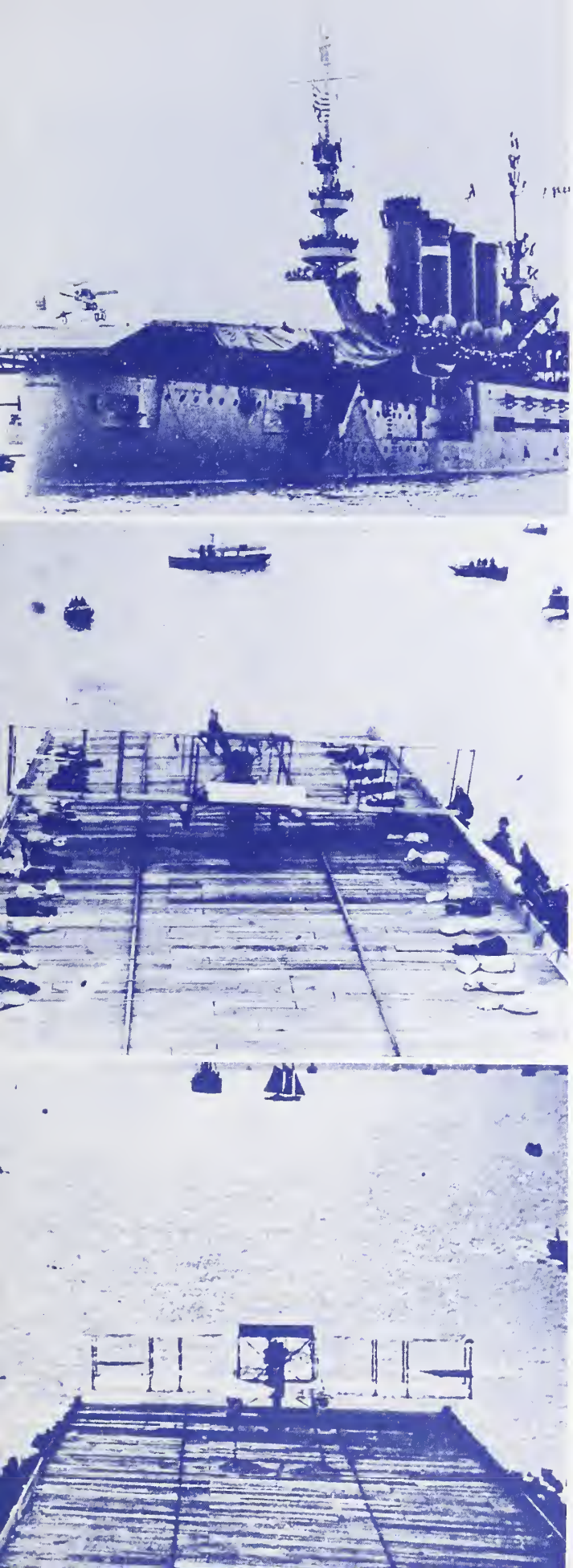
This board should have the power to call in outside experts like R. H. Thureton, Preeident Sibley College, Cornell Univsrsity, and Octave Schanute, Preeident of American Society of Civil Engineere, at Chicago.

Very respeotfully,

T. Roosevelt
Assietant Secretary.

The Honorable,

The Secretary



As the airplane developed toward a usable weapon, in September 1910 the United States Navy began to weave it into seapower. Captain Washington Irving Chambers was assigned to answer all correspondence about aviation and to keep himself fully informed on developments in the field. Captain Chambers, an able aggressive and far-seeing officer, to be cited by the Aeronautical Society as "first to demonstrate the usefulness of the aeroplane in navies," immediately launched a study into the problem of designing and building aircraft for fleet scouting and reconnaissance.

Captain Chambers' path soon crossed that of Glenn H. Curtiss, pioneer airplane builder. Together they promptly took steps to improve the practicability of airplanes operating from ships, and arranged a series of tests to demonstrate the feasibility. Within months they achieved world firsts that pointed the way to the gigantic influence of aviation, properly integrated, in increasing the powers of navies to control the sea and to operate against forces based ashore.

On November 14, 1910, in the presence of key naval officers, a Curtiss associate, Eugene Ely, took off from a specially constructed platform on the scout cruiser USS BIRMINGHAM in Chesapeake Bay and flew to the beach at Willoughby Spit, two miles distant.

Two months later they accomplished an even more significant step. January 18, 1911, Ely took off from shore at San Francisco, landed on a platform built over the after deck of USS PENNSYLVANIA, turned his airplane about, took off and flew back to shore.

On February 17, 1911, a hydro-aeroplane with Glenn Curtiss at the controls taxied alongside and was hoisted aboard USS PENNSYLVANIA in San Diego harbor. When his plane was again waterborne, Curtiss taxied back to his aviation camp on North Island in a practical display of the airplane's capability to operate from ships of the fleet.

On this sound foundation of practical tests the Navy was ready to build intelligently. Secretary of the Navy George von L Meyer recommeneded the purchase of naval aircraft. On May 8, 1911 the Department initiated an order for two Curtiss airplanes and the birth of Naval Aviation was a reality.

What a stirring future awaited.

Top. Eugene Ely about to land on specially constructed platform on stern of USS PENNSYLVANIA. Center. Ely's aircraft carrier arresting gear; principle still used today. Bottom. Having turned plane around, Ely takes off returning to field ashore.

Glenn Curtiss (at controls) and LT ELLYSON in the Curtiss A-1. Extracts from the log of this first U.S. Navy aircraft.

REMARKS.

Set up engine for A1 in block and ran it 14 times in periods of … Total time run 37 min. The engine was hard to start owing to the spark being advanced … did not throttle well, and the water jackets on all cylinders except #3 and #4 leaked badly. The engine received too much oil owing to the stand pipes in the splash pan being too high. Thrust 470 lbs. Rev. 1170. Propeller 8' diam. 6' pitch. Lieut. (j.g.) Towers, J.H., U.S.N., reported for duty.

Disassembled A1 engine and thoroughly overhauled same. Bronze had been used for the caps of all bearings. It was found that these had started to rub the shaft, so babbitt bearings were substituted. The crank pin bearings had slightly rubbed the splash pan, so the latter was lowered 1/4 inch. A slight flaw was found in #5 cylinder, and a new one was substituted. The compression was too great owing to insufficient clearance, so 1/8" risers were installed under each cylinder.

Started to set up A1 machine and installed standard Curtiss 50 H.P. motor.

June 29 Finished setting up A1 machine.

June 30 G.H. Curtiss tried out A1 machine, 50 H.P. motor, and found balance on the water and in the air perfect. He then took Lt. T.G. Ellyson as a passenger, and found the balance with extra weight perfect. Lt. Ellyson tried for pilot's license in

July 1 A1, but did not qualify as the judges later decided that he had not been given … instructions.

Signature T.G. Ellyson, Lieutenant, U.S. Navy

A1, DATE July 1, 1911, to July 5

No. of flight	Operator name	Weight	Passenger name	Weight	Time at rising of flight	Duration of flight	Approximate altitude above surface
11	Lt. T.G. Ellyson	170					
12	"	"					
13	"						
14	G.H. Curtiss	145	Capt. W.I. Chambers, USN		6 p.m.	17 m	350'
	"		C.C. Witmer		7 p.m.	16 m	300'
	"		A.F. Zahm		7 p.m.	10 m	50'
		170	Capt. W.I. Chambers	155	8 p.m.	5 m	25'
						10 m	50'
	170						
	"					17 m	—
						23 m	—
	145	Lt. T.G. Ellyson	170			19 m	600'
						11 m	400'
					2 p.m.	25 m	50'

REMARKS.

July 1 Captain W.I. Chambers, U.S. Navy, in charge of naval aviation, arrived on inspection trip.

July 3 Ran A1 engine on block 15 minutes.

Lt. T.G. Ellyson, U.S.N. qualified for aviation pilot's license.

Lt. T.G. Ellyson, with Captain W.I. Chambers, U.S.N., attempted to fly from Hammondsport to Penn Yan, N.Y., 22 miles, 50 H.P. motor. There was no wind and it was impossible to leave the water, but the trip was made on the water. Stopped at Urbana, 8 miles from Hammondsport, then made rest of the run without mishap.

The return trip to Hammondsport was made by Lt. Ellyson alone. Stopped at Urbana after dark for oil. It was very dark when Hammondsport was reached, and as there was no light as an aid, the distance from the water was very misleading. The first attempt to land was a failure, the machine striking the water and rising again. On second attempt a normal landing was made.

A1 engine given 4 runs in block for total time of 1h 10m. Oil leaked badly around cap at rear end of cam shaft bearing. Put in lead gasket … stuffing leaks. Oil pump delivering too much oil, but decided not to change until the engine was thoroughly limbered up. Spark plugs fouled … due to this cause. Ran engine with plugs out of #1, 3, 5, & 7 cylinders.

Signature T.G. Ellyson, Lieutenant, U.S. Navy

HYDRO-AEROPLANES.

Speed, 60 m.p.h. Type, Biplane, Single pontoon No.

B.H.P. 75 R.P.M. 1050-1260

Pitch, 5'4" R.P.M. 1060-1260

Beam, 29½' Draft, 11½"

Depth, 5' Freeboard, 1"

Clearance, 5' Area, 286 sq. ft.

Type, … SURFACE. Beam, 28'8"

CONTROLS.

Vertical, - Type Balanced

Horizontal, -

Stabilizers, -

Wing, -

Dimensions

WEIGHT IN POUNDS.

Hull,	126
Plane and Fittings,	500
Machinery,	330
Water,	50
Gas,	180
Oil,	42
Equipment,	27
Crew,	360
Total,	1575

COST.

Hull, - $

Planes, Controls, and Fittings, -

Machinery, -

Total, - $10,000

Sketch Form.

Plan No.

Ordered:

Built by: Curtiss Aeroplane Co.

Completed: July 1911.

Assigned to: Experimental

Date.

Transfers.

Hammondsport, N.Y.

RECORD—U.S. NAVY AEROPLANE No. A1, DATE July 5

Date	Weather	Wind Direction	Wind Force	Bar.	Ther. Dry.	No. of flight	Operator name	Weight
July 5						15	G.H. Curtiss	145
July 6						16	"	145
						17	G.H. Curtiss	145
July 7						18	"	145
						19	"	145 Lt. T.G. Ellyson

Almost all the officers of the Aviation Corps USN are shown in this picture taken in 1914. Several gave their lives pioneering aviation. Most of the others rose to important commands. Left to right; LT V. D. Herbster, LT W. M. McIlvain, LT P. N. L. Bellinger, LT R. C. Saufley, LT J. H. Towers, LCDR H. C. Mustin, LT B. L. Smith, ENS G. deC Chevalier and ENS M. L. Stolz.

Naval aviation steadily developed and made other notable contributions, including early world endurance, speed and altitude records. These achievements further accelerated development of the decisive air element of sea power. On the fateful eve of World War I a United States Navy news release on 10 January 1914 stated:

> "The Secretary of the Navy has decided that the science of aerial navigation has reached that point where aircraft must form a large part of our naval force for offensive and defensive operations. Nearly all countries having a Navy are giving attention to this subject. This country has not fully recognized the value of aeronautics in preparation for war, but it is believed we should take our proper place."

On the very day of Secretary Daniels' momentous announcement, two ships, USS MISSISSIPPI and USS ORION, were heading southward with all the new equipment necessary for the establishment of a naval air station. Arriving at the old Pensacola Navy Yard in Florida, an enthusiastic young band of Naval Aviators transformed the old yard into the U. S. Naval Aeronautic Station, Pensacola. A number of new aircraft were purchased and soon the first of many thousands of naval aviators to be trained at Pensacola were earning their coveted wings of gold.

Planes parked in front of their tent hangars at the Naval Aeronautic Station, Pensacola in 1914. The Flight School had six aircraft, six qualified commissioned pilots, and 23 enlisted men as its complement.

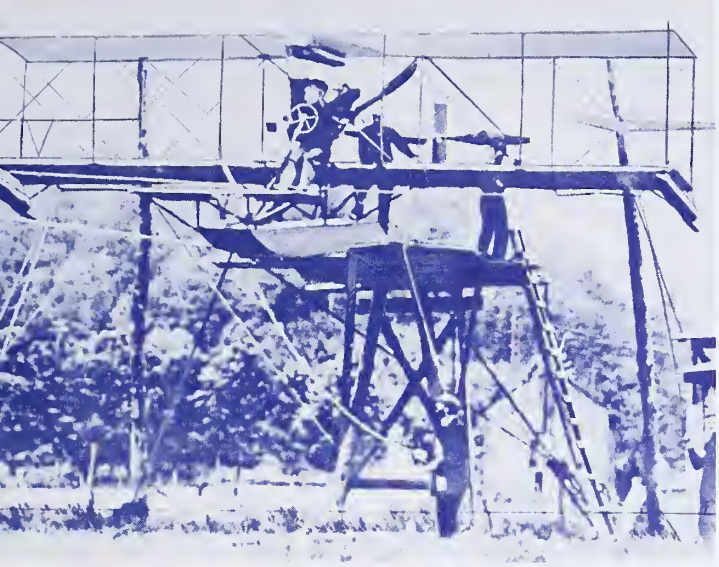
Ensign C. H. Maddox seated on the Wright B-1 with the radio gear he designed and installed. Though not a pilot himself, Maddox made many flights with Lt John Rodgers to test the radio equipment.

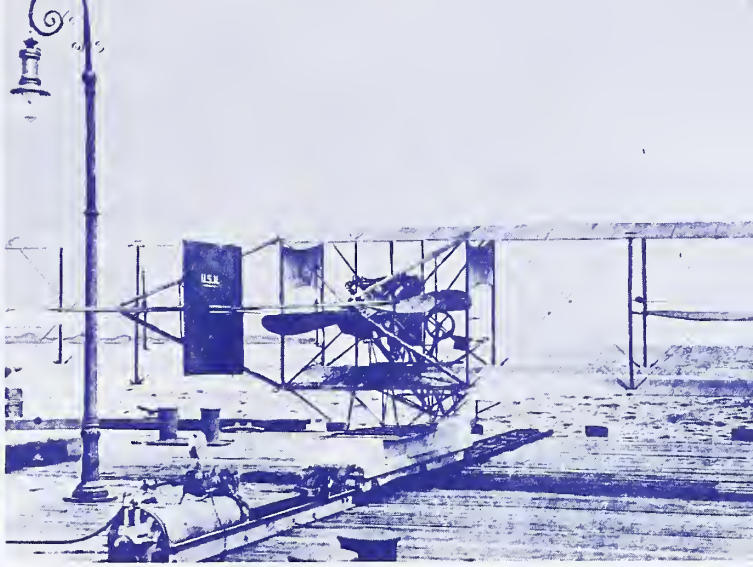
First U.S. Navy aerial photographer, W. L. Richardson seated by LT E. Johnson in an AH-14 at Pensacola in 1914. Handling the heavy Graflex at 50 knot airspeeds was a hazardous feat.

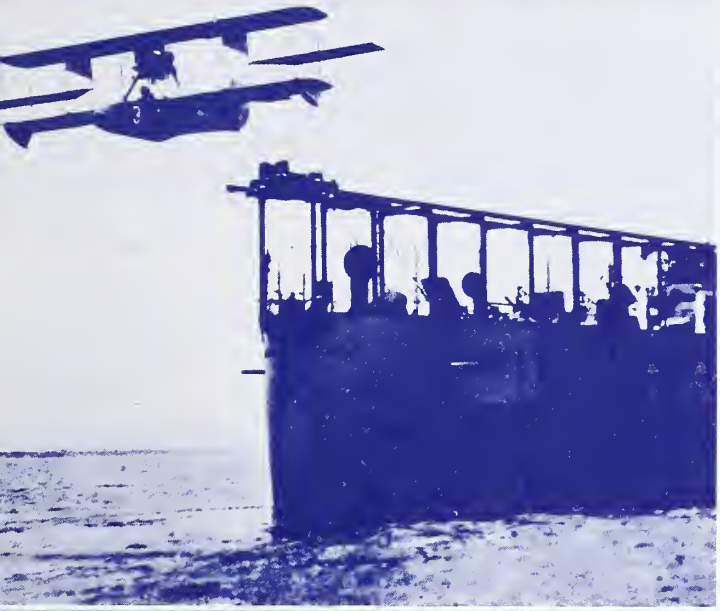
As early as 1912 naval officers were pushing forward such innovations as an automatic pilot, methods for aerial torpedo attack, airborne radio and catapult launchings. In the winter fleet maneuvers of 1913, pilots had demonstrated that their airplanes could be profitably employed for scouting, for detecting submarines and mines, and for aerial photography. Much development work remained to be done, however, before aircraft could accompany the Fleet to sea. The Navy was uniquely fitted for this development with its experienced shipbuilders and experts in the wide range of engineering and technology that enter into the complex scientific Navy of the twentieth century. Naval laboratories, test facilities and other activities were available with skilled men experienced in adapting new developments into the existing fabric of the Navy. For example, a number of important achievements, including early catapult launchings, took place at Annapolis and the Naval Gun Factory. Work went forward with particular success after Rear Admiral David W. Taylor became Chief of Bureau of Construction and Repair late in 1914, and under the impetus of world war larger appropriations were made.

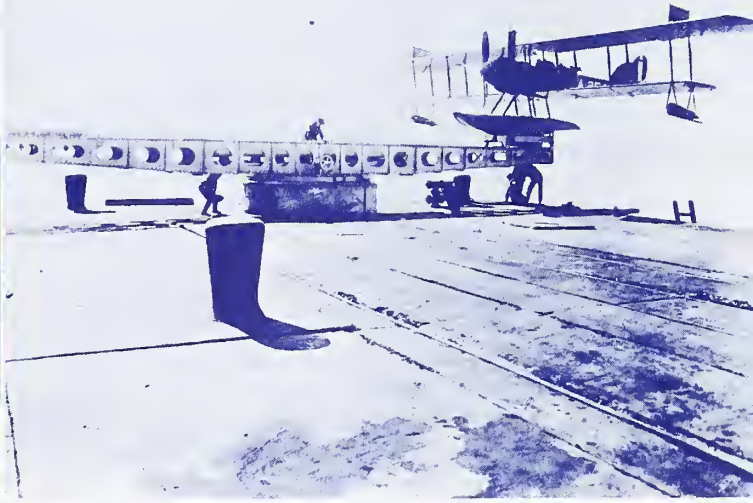
From the primitive aircraft of 1914 to the triumphant carrier task force of the 1940s there lay false starts and dashed hopes, as well as great advances and significant achievements. These false starts, however, never took the Navy far down blind alleys because the aviators who pressed the devclopments were rounded naval officers with practical seagoing experience. Through all change and development, the Navy never lost sight of its primary objective—the adaption of the new element of aviation to warfare at sea as an integrated element of the fleet. Out of this unity of integration the whole was far stronger than any of its parts.

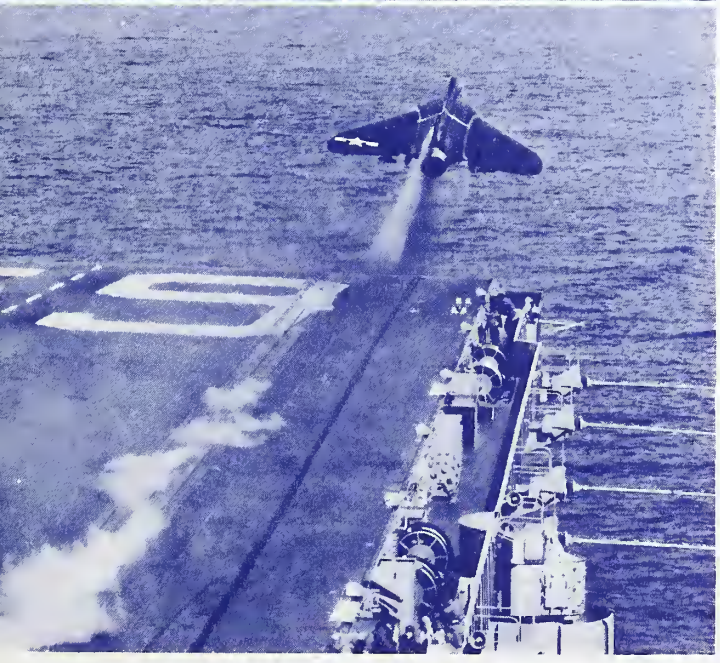
In the same eventful year of 1914 Navy wings received their baptism of fire that spring at Vera Cruz. Planes assigned to USS MISSISSIPPI made reconnaissance flights over the anchorage and scouting sweeps over the enemy lines. LT P. N. L. Bellinger returned with bullet holes in his airplane—The first combat scars for naval aviation.





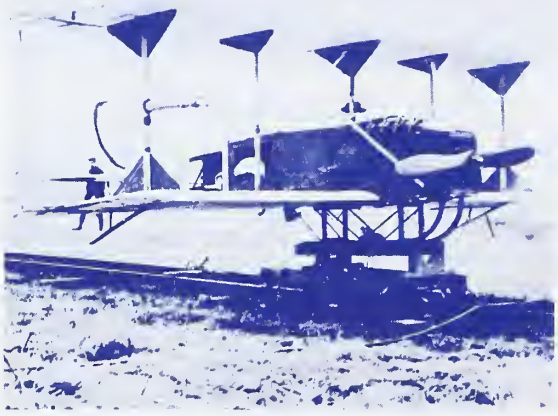






EVOLUTION OF THE CATAPULT — — —

LT Ellyson preparing to slide down greased inclined wire. Principle was used to launch liaison aircraft from LSTs during World War II. Top right. Curtiss pusher type airplane on compressed air catapult at Annapolis in 1912. Center left. 1916 catapult launching from USS NORTH CAROLINA. First catapult launching from a moving ship occurred on USS NORTH CAROLINA on November 5, 1915. Center right. Early turntable catapult; forerunner of those used on battleships and cruisers in World War II. Bottom. Powerful steam catapult of present day attack carrier capable of launching heaviest jet bomber designed for carrier use.

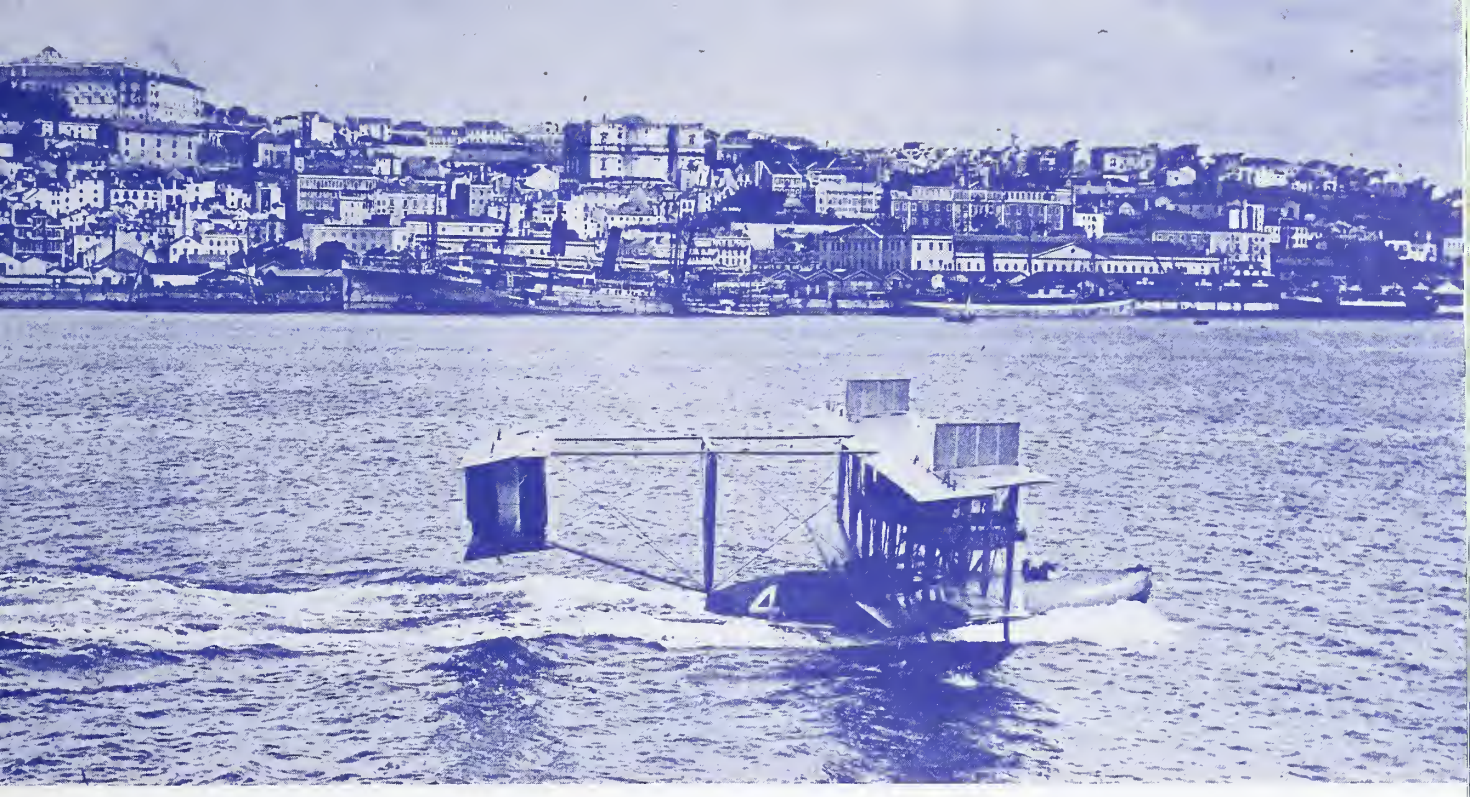


Top left. N-9 trainer, widely used to train Naval Aviators in World War 1. These planes also used by Marine Aviators for patrol duty in Azores during the war. Top right. H-16 flying boat, used for anti-submarine patrol in World War I, carried a crew of 4, a radio, two 230 pound bombs, four machine guns and cruised about 4 hours at 95 knots. Left. First guided missile, a pilotless plane consisting of a special Curtiss airframe, OX-5 engine and Sperry automatic controls. Test flights were made from a secret field at Copiague, Long Island, before the armistice put an end to this project. Between the Wars the Navy continued to work on remote control and put "drone" planes in the air for anti-aircraft gunnery training and development. On this foundation in World War II, the Navy soon produced remote control planes (guided missiles), including television control, and went into action with them in the Pacific.

By 1917 United States naval aviation had made long strides in the six years of its existence, but was not ready to play a decisive role in warfare at sea any more than aviation was ashore. In the nineteen months between the declaration of war and the armistice, however, phenomenal expansion took place. In vastly expanded expenditures for all purposes the Navy spent $143,000,000 on aviation, compared to a total of approximately five million through 1916. Flying boats and seaplanes rose from 51 to 1865; land planes from 3 to 242; officers from 48 to 6998, and enlisted men from 239 to 32,873. If not decisive, naval aviation did play an important and increasing role, especially in combatting the other relative newcomer to the power of navies, the submarine. Naval aircraft logged over 3 million nautical miles on patrol and bombing missions, dropped 126,302 pounds of bombs on German submarine bases and other military targets, attacked 25 German submarines and sank or damaged a dozen of them.

A generation later when undersea attack had become far more of a menace naval aviation had fortunately also come of age. Integrated into the overall Navy, it both gave and received vast new possibilities. Its aircraft of many types, especially those operating from the swift mobile landing field of aircraft carriers, were a key to defeat of the undersea menace and therefore to victory for the Free World.

Naval aviation sparked the enthusiasm of the nation's young men. A number of 'Units' were formed at colleges, and many of the men who became naval reserve aviators during World War I later served as high ranking defense officials. Among these were James Forrestal, the first Secretary of Defense, David S. Ingalls and Artemus L. Gates, Assistant Secretaries of the Navy for Air, and F. Trubee Davison and Robert A. Lovett, Assistant Secretaries of War for Air. (Mr. Lovett was later Secretary of Defense.)



The U. S. Navy's NC-4 taxies triumphantly into Lisbon harbor May 27, 1919, upon completion of its famous flight, the first aerial crossing of the Atlantic.

One of the outstanding developments of the war was the long distance flying boat. Rear Admiral David W. Taylor envisioned craft capable of crossing the Atlantic non-stop, able to engage a U-boat upon their arrival, with an ability to carry tremendous passenger or cargo loads, and built to keep the sea in any weather if forced down. Naval Constructors Westervelt, Richardson, and Hunsaker, in collaboration with Glenn Curtiss, designed the huge planes with three Liberty engines, 45 foot hulls, and 126 foot wing spans. The NCs as the craft were designated, arrived too late to serve in the war, but the Navy proceeded to test their ability to cross the Atlantic. With a fourth engine installed and improved propellers, three of the NCs took off from the Naval Air Station, Rockaway Beach, N.Y. on May 8, 1919. At Newfoundland, they waited until May 16 to continue their journey. Just as surface and undersea forces depend on the air Navy, so aircraft depend on the forces over which they soar. For the occasion, 68 destroyers were strung across the Atlantic to the Azores as marker buoys, with five battleships serving as weather stations every four hundred miles.

Distances had been carefully calculated and engines checked, yet there remained the difficult problem of over-water navigation. Both NC–1 under pilots Bellinger and Mitscher, and NC–3 under Towers and Richardson, came down on the surface to check position and ran into trouble. Towers sailed his craft into the Azores but it was too badly battered to continue, while NC–1 capsized and sank when taken in tow by a passing steamer. NC–4, with LCDR A. C. Read USN commanding and LT E. F. Stone USCG as pilot, reached the Azores in flight. After several days, NC–4 flew on to Lisbon and finally to Plymouth, England, becoming the first plane to make an aerial crossing of the Atlantic.

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Although seaplanes and airships continued to be of recognized importance, as with most other revolutionary developments the Navy knew instinctively that: *the more the new weapon was brought to the ship and woven into past experience the greater would be its value and the larger the impact upon the growth of seabased power.* Hence emphasis steadily moved toward specially constructed aircraft carriers (with wide unencumbered deck) capable of steaming at high speeds anywhere the fleet could go and of rapidly launching and receiving large numbers of planes.

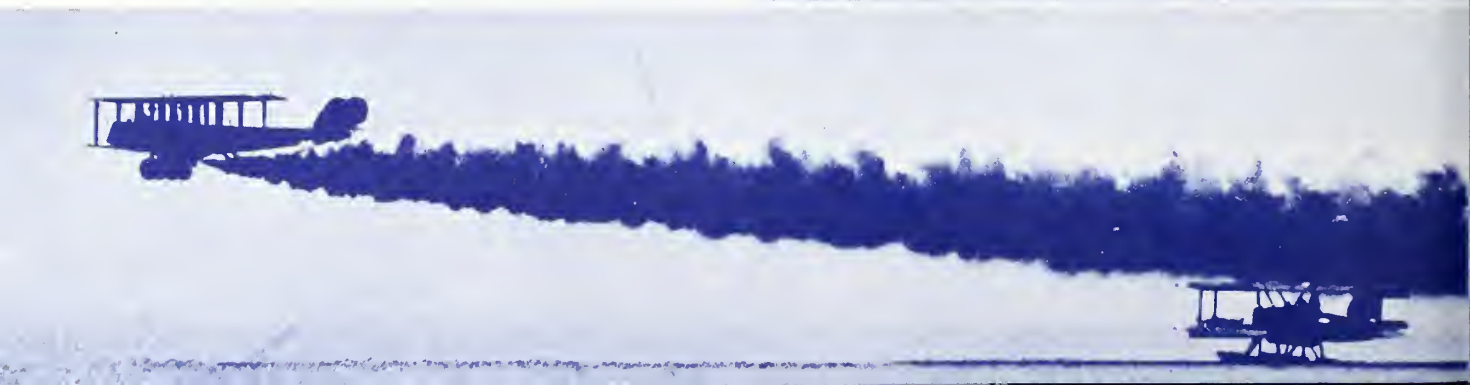
The Navy was able to forge into this revolutionary power of the air, the same elements that had made its gunnery so feared—flexibility, rapidity of delivery, precision and overwhelming concentration of fire. So fleets acquired enormous added hitting power and at the same time maximum protection through maintaining the landing field wherever the ships sailed.

In 1919, Congress authorized the conversion of the collier JUPITER into a carrier and on March 20, 1922 the ship was commissioned USS LANGLEY, CV–1. Later that year the first take-offs and arrested landings were made on LANGLEY with Aeromarines and Vought VE–7SF, fitted with landing hooks. The lessons learned on LANGLEY were incorporated in the 33,000 ton USS LEXINGTON and USS SARATOGA, converted Battle Cruiser hulls and commissioned in 1927.

This decade of the development of the carrier stands out in the history of naval aviation as a period of phenomenal growth. At the beginning, a small detachment in each ocean fleet owed its existence to a decision to give aviation the chance to prove itself under the practical conditions of operating at sea. It was a period of declining appropriations, yet the Navy devoted a steadily growing larger share to aviation. Hence at the end, three aircraft carriers were in full operation, patrol squadrons and seaplane tenders were performing essential scouting functions, aircraft were regularly assigned to battleships and cruisers, and together these elements were playing an important role in the offensive and defensive maneuvers of the annual fleet war games.

A bomb just after release from a seaplane during bomb development test of 1919. A second bomb still hangs on rack under left wing.

One of the earliest tests of torpedo bombing was made on September 14, 1920, when a R6L dropped a torpedo in San Diego harbor. Torpedo bombing had long had its advocates and test was proof of efficiency of tactic which boded ill for enemy ships. Below. Smoke screen is layed by Martin MT heavy bomber to screen ships during fleet maneuvers.



Center. USS LANGLEY CV-1 Upper left. USS LEXINGTON CV-2 Upper right. USS RANGER CV-4 Lower left. USS ESSEX CV-9 Lower right. USS INDEPENDENCE CVA-62

The period was also characterized by impressive technical progress. The radial air cooled engine was developed into an efficient and reliable power plant. The full impact of this development was realized by the U. S. air industry some years later as this type of engine was used almost exclusively as the power plant for all types of aircraft. Better instruments and more satisfactory radios were put into use; an accurate bomb sight was developed. Bought by the Army Air Corps, this sight played an immense role in the strategic bombing concept of World War II. Aircraft were equipped with oleo struts and folding wings to enhance operations from the aircraft carriers. Aircraft flew higher, faster and farther each year and of the many world records placed on the books, a fair share of them were put there by naval aircraft.

Tactics were developed. Accurate dive bombing became an accepted tactic that was to prove decisive in naval battles still two decades in the future. Marines learned the value of air support. Techniques of torpedo attack, scouting, spotting of gunfire, and operating from advanced bases were developed and refined into doctrine. Everywhere it was evident that the Navy was solving its unique problems of taking aviation to sea; by solving them was gaining new strength from this revolution (that some claimed would do away with navies); and was thereby carrying out its duty to the destiny of the sea girt United States.

Boeing F4B, popular carrier fighter of the 1920's and early 1930's.

T4M, large Martin torpedo bomber, flew from decks of famed SARATOGA and LEXINGTON.

During the 1930s naval aircraft were developed for specific missions such as scouts, fighters, dive bombers, torpedo bombers, trainers and patrol planes. In all types the change from biplane to single wing design gradually occurred. Retractable landing gear increased the speed of all landplanes. The period was also characterized by the use of increasing masses of aircraft. In 1934 an entire squadron, VP–10, flew from California to Pearl Harbor; whereas only nine years previous, Commander John Rodgers had established a world distance record for seaplanes when he had been forced down 1,841 miles out of San Francisco in his attempt to fly to Hawaii non-stop. What had been individual feats a few years back were now being translated into squadron efforts.

Loening OL–8 amphibian. In this type aircraft RADM Richard E. Byrd made his pioneering flights in the Arctic.

The USS MACON shown in flight with her protective fighters preparing to hook on. The MACON had not had two full years of service when a structural failure brought her down off Point Sur, California where she sank on February 12, 1935. All but two of her crew were saved. Inset. An F9C-2 fighter hooked on just prior to being hoisted into the MACON.

Large rigid airships enjoyed a brief period of glory and they became familiar sights in the sky over the United States. A series of tragic crashes, due to structural deficiencies, led to their abandonment for the smaller non-rigid type airship.

This was a period in which tactics were proven, doctrine was revised and aircraft became an integral part of a powerful Navy. USS RANGER, first ship built as a carrier from the keel up, joined the fleet in 1934, and was soon followed by the much faster YORKTOWN, ENTERPRISE, WASP and HORNET. These latter carriers, along with LEXINGTON and SARATOGA, played an important role in turning the tide of battle in those first fateful months of World War II.

The famed PBY. They were slow but possessed tremendous endurance permitting them to maintain constant tracking of enemy forces. Mainstay of Navy prewar patrol aviation, doing yeoman service in all theaters, ably carrying out all sorts of missions throughout the war and were not retired from active service until 1957.

P2Y flying boat over Oahu on January 10, 1934, at the completion of a record breaking flight of 2,408 miles from San Francisco.

COMMANDER-IN-CHIEF
FLAG OFFICE
RECEIVED

Cincpac File No. A16

UNITED STATES PACIFIC FLEET
FLAGSHIP OF THE COMMANDER-IN-CHIEF

JUN 28 1942

SECRET DECLASSIFIED

From: Commander-in-Chief, United States Pacific Fleet.
To: Commander-in-Chief, United States Fleet.

Subject: Battle of Midway.

Reference: (a) CincPac A16/(90) Ser. 01693 of 6/15/42.

Enclosures:
(A) Track of the Battle of Midway - Composite of all Reports.
(B) Copy of Cincpac A8/(37)/JAP/(26.2)(no date) and Cincpac A8/(37)JAP/(26) Ser. 01753 dated 21 June 1942.
(C) ComCru,Task Force SEVENTEEN A16-3/(013) dated 12 June 1942.
(D) Copy of Comtaskforce SEVENTEEN A16-3/A9(0029N) dated June 26, 1942.
(E) Copy of NaS Midway Na38/A16-3 Serial 075 dated 18 June 1942 with ComHawSeaFron. 1st End. thereon.
(F) Summary of Army Aircraft Attacks at Midway, ComGen.Haw.(8672).

1. In numerous and widespread engagements lasting from the 3rd to 6th of June, with carrier based planes as the spearhead of the attack, combined forces of the Navy, Marine Corps and Army in the Hawaiian Area defeated a large part of the Japanese fleet and frustrated the enemy's powerful move against Midway that was undoubtedly the keystone of larger plans. All participating personnel, without exception, displayed unhesitating devotion to duty, loyalty and courage. This superb spirit in all three services made possible the application of the destructive power that routed the enemy and inflicted these losses:
(a) 4 CV sunk - AKAGI, KAGA, SORYU, HIRYU - with the loss of all their planes and many of their personnel. Estimated 275 planes, 2400 men.
(b) 2 probably 3 BB damaged, 1 severely.
(c) 2 CA sunk - MOGAMI, MIKUMA - 3 or more others damaged, some severely.
(d) 1 CL damaged.
(e) 3 DD sunk, 1 other possibly sunk.
(f) 4 AP and AK hit, 1 or more possibly sunk.
(g) Estimated total number of personnel lost 4800.

2. These results were achieved at the cost of the YORKTOWN and HAMMANN sunk and about 150 planes lost in action or damaged beyond repair. Our total personnel losses were about ninety-two(92) officers and two hundred and fifteen (215) men.

27. This was the situation when our carrier attack began. Task Force 16 and 17, ready about 200 miles to the northeast of the Japanese carriers, had intercepted the first contact reports by the Midway scouts. At about 0700 launching commenced of the following attack groups, YORKTOWN's being temporarily held in reserve until her scouts returned (majority of fighters retained for combat patrol):

HORNET - 35 VSB, 15 VTB, 10 VF
ENTERPRISE - 35 VSB, 14 VTB, 10 VF

(Bombers carrying 1-1000 lb, or 1-500 lb, or 1-500 and 2-100 lb bombs)

These two groups proceeded independently to attack.

32. Not a plane survived this magnificent devotion to purpose. One pilot, after attacking and probably hitting the KAGA at close range, with his gunner already killed, crashed near the AKAGI, ducked under his seat cushion to prevent being machine gunned, and from this reserved position observed the fierce attacks that followed.

35. When the HORNET torpedo squadron attacked, there were 4 carriers dispersed in a wide roughly circular formation. AKAGI, KAGA and SORYU were in the same general vicinity, probably having just landed planes. SORYU was smoking, showing signs of heavy damage, as was also a ship some distance away that resembled a battleship. The surviving HORNET VT pilot, Ensign Gay, USNR, had been in the water only a few minutes when the ENTERPRISE and YORKTOWN dive bombers struck hard and most effectively. Both KAGA and AKAGI, between which he lay, were hit repeatedly, the planes on deck that they sought to launch being ignited until the two ships burned fiercely from stem to stern. SORYU was also hit again and continued to burn.

90. The performance of officers and men was of the highest order not only at Midway and afloat but equally so among those at Oahu not privileged to be in the front line of battle. I am proud to report that the cooperative devotion to duty of all those involved was so marked that; despite the necessarily decisive part played by our three carriers, this defeat of the Japanese Arms and ambitions was truly a victory of the United States' armed forces and not of the Navy alone.

C. W. NIMITZ

Air attack on KAGI and AKAGI (by Coale).

In most of her wars America has not been ready because of unwillingness to devote an adequate part of her income in peace so that she might be prepared against war—preparation that in effect could prevent conflict and therefore save many times the investment. Once caught up in the maelstrom, however, she has responded valiantly. As her industrial might built up to flank-speed, the desperate need for more and more ships of every type began to be met.

By 1943 additional carriers, battleships, cruisers and destroyers joined the unbeatable teams of fast carrier task forces. At the same time greatly improved fighter direction, radar and anti-aircraft armament, including the influence fuse, insured virtual suicide for attacking aircraft. The United States' doctrine of full interweaving of air with other fleet strengths, for offensive and defensive, now paid 100% dividends.

Powerfully and inexorably, behind the spearhead of the fast carrier task forces (and with close air joined with precise gun fire support on the beach), the United States drove her offensive in great leaps across the Pacific:
From Tarawa and Kwajalein to Saipan and the Battle of the Philippine Sea, to Leyte Gulf, on to Iwo Jima, Okinawa, the home islands of the Japanese and at last into Toyko Bay itself.

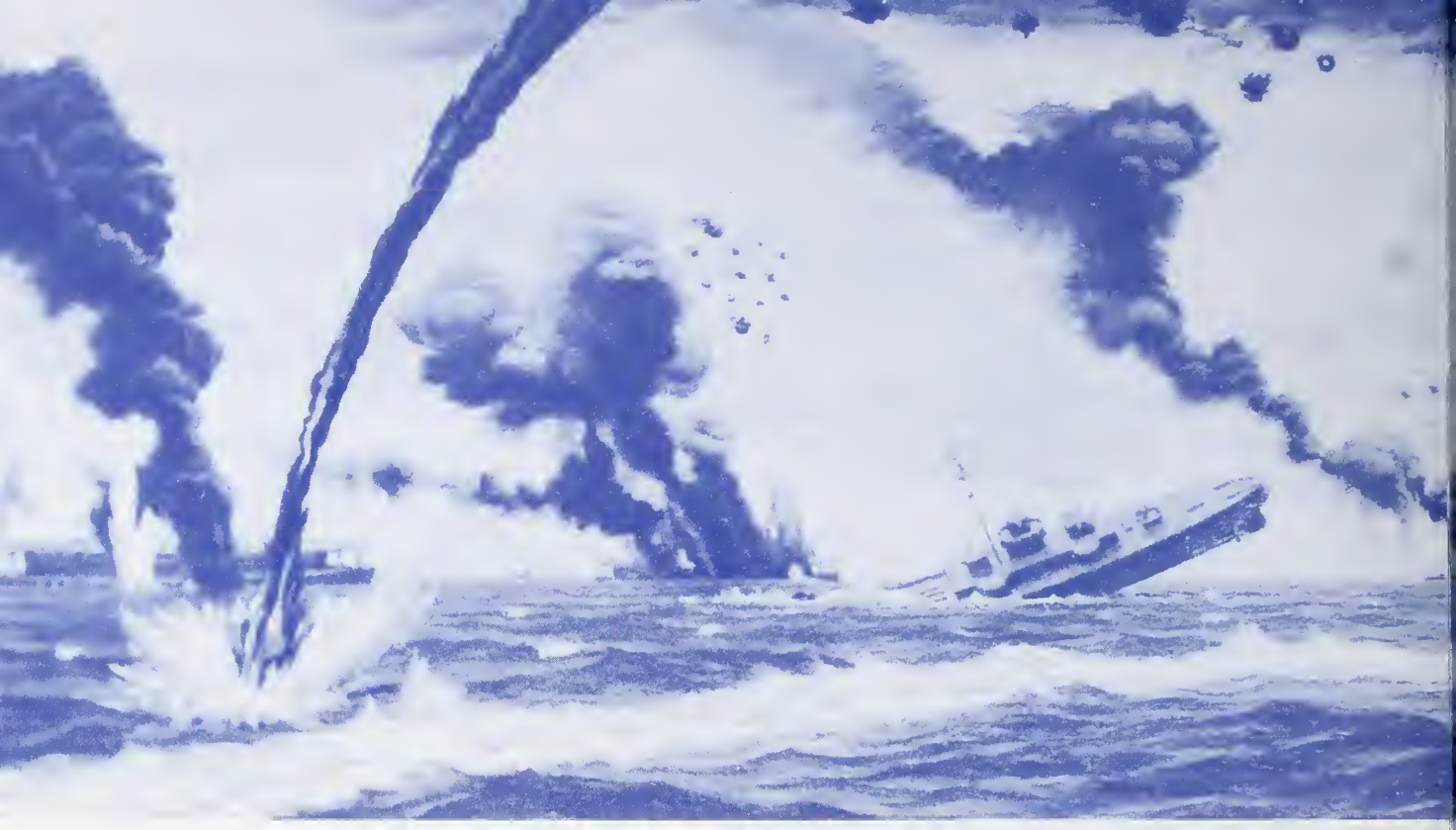
Not only did Naval Aviation, joined with ships of the fleet, spearhead this drive but the planes themselves sank 174 Japanese warships, including 13 submarines, and 447 Merchant ships;

Japanese heavy cruiser MIKUMA on fire after dive bombers attacked in Battle of Midway.

The single wing F4F was the front line carrier fighter as the United States entered the war.

Lower left.
The giant killer SBD Dauntless sank more Japanese ships than any other aircraft in World War II. In Battle of Midway alone, the SBD's contributed immensely toward sinking of four large carriers and one heavy cruiser.

TBD Devastator, standard carrier torpedo bomber at start of the war, was underpowered, underarmed and too vulnerable to enemy fighters.



DIVE BOMBING JAPANES

(by

By the time the fateful test of World War II burst upon civilization naval aviation though too small, as was all the Navy, nevertheless responded magnificently to the severe demands placed upon it. In the months after the Pearl Harbor attack, the greater number of our battleships were out of action undergoing repairs. The major burden of checking the Japanese advance fell upon our few submarines and aircraft carriers escorted by cruisers and destroyers—to be powerfully supplemented soon by the new fast battleships with their potent anti-aircraft batteries. The early strikes on the Marshall and Gilbert Islands, and the Doolittle Raid on

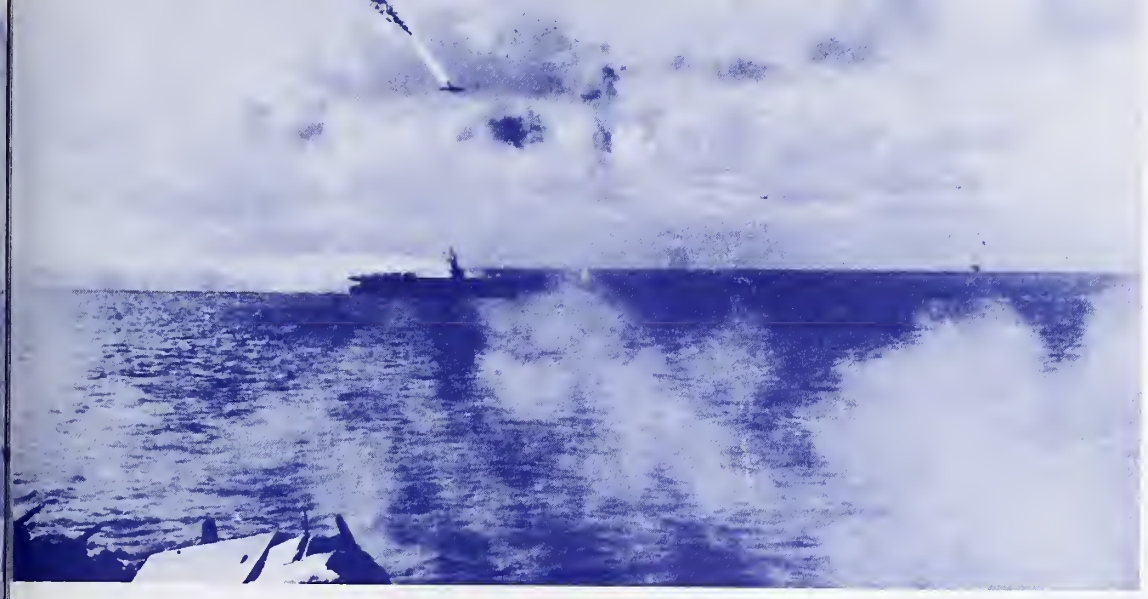
CARRIERS AT MIDWAY

ale)

Tokyo launched from the deck of USS HORNET raised American morale and shook Japan. Then followed two notable fleet engagements that set a new course in warfare. Navies now locked in combat that decided campaigns and even wars without capital ships sighting each other. Naval Aviation had come of age. In the crucial carrier battle of the Coral Sea the Japanese southward push was stopped, and in the decisive and stunning victory at Midway, U. S. Naval Aviation turned the enemy back. No battle in the Pacific War and few in history would have greater impact upon ultimate victory and the fate of man in his struggle toward freedom.

Repelling Jap air attack at Santa Cruz. USS HORNET was lost in this action.

A blimp maintains its vigil over a convoy in the Atlantic.



Kamikaze shot down attempting attack on USS KITKUN BAY CVE-71.

and helped destroy an additional 33 warships, including 7 submarines, and 39 merchant vessels. In the Atlantic, United States Navy planes destroyed 63 German submarines and helped sink 20 more in the far spread and crucial "Battle of the Atlantic".

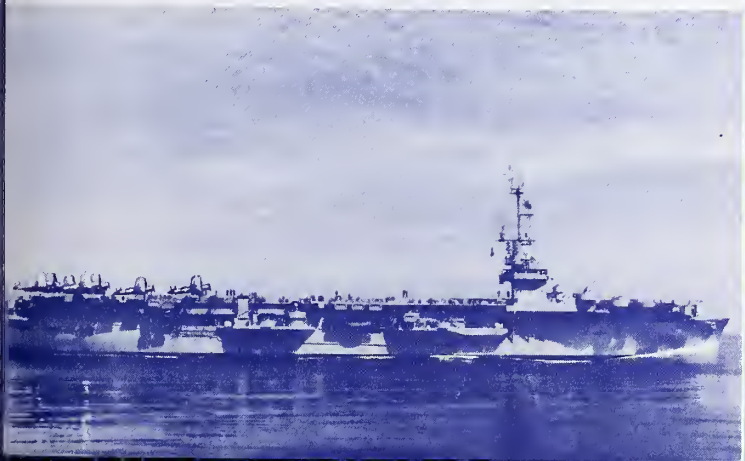
In all, more than 40,000 naval planes flew about a quarter million sorties against land targets, some 36,000 against enemy ships and a host against enemy aircraft.

Desperate indeed would have been the United States' fate had its Navy not contested the seas with aircraft carriers (and for years some Americans advocated their abandonment). Changed indeed would have been all our futures if this revolution in warfare had not, like many before it, been fully and wisely integrated into the Navy.

The Navy employed planes not only in fast Carrier Task Forces, but wherever needed and in whatever capacity they could contribute to the complex functions and demands of sea-based warfare. These are manifold since modern Navies must operate for offense and defense in three strata at sea as well as against the beach. Another versatile member of air-ship teams was the "jeep" carrier with its hardworking crew and effective planes. The escort carriers, designed for anti-submarine work and instrumental in winning the Battle of the Atlantic, soon proved their ability to cover amphibious landings and on one occasion, to engage in combat against heavy naval forces. Patrol planes spent many long hours looking for enemy submarines and striking enemy shipping. Observation aircraft launched from battleships and cruisers spotted the destructive gunfire support rendered by these ships. Airships on anti-submarine patrol over convoy routes, utility planes, transports and trainers—all provided vital services. World War II demonstrated how effectively aviation had been integrated into the fleet; air power had truly gone to sea.

USS SICILY CVE-118. Escort carriers conducted Anti-submarine warfare in the Atlantic and provided close air support for amphibious landings in the Pacific.

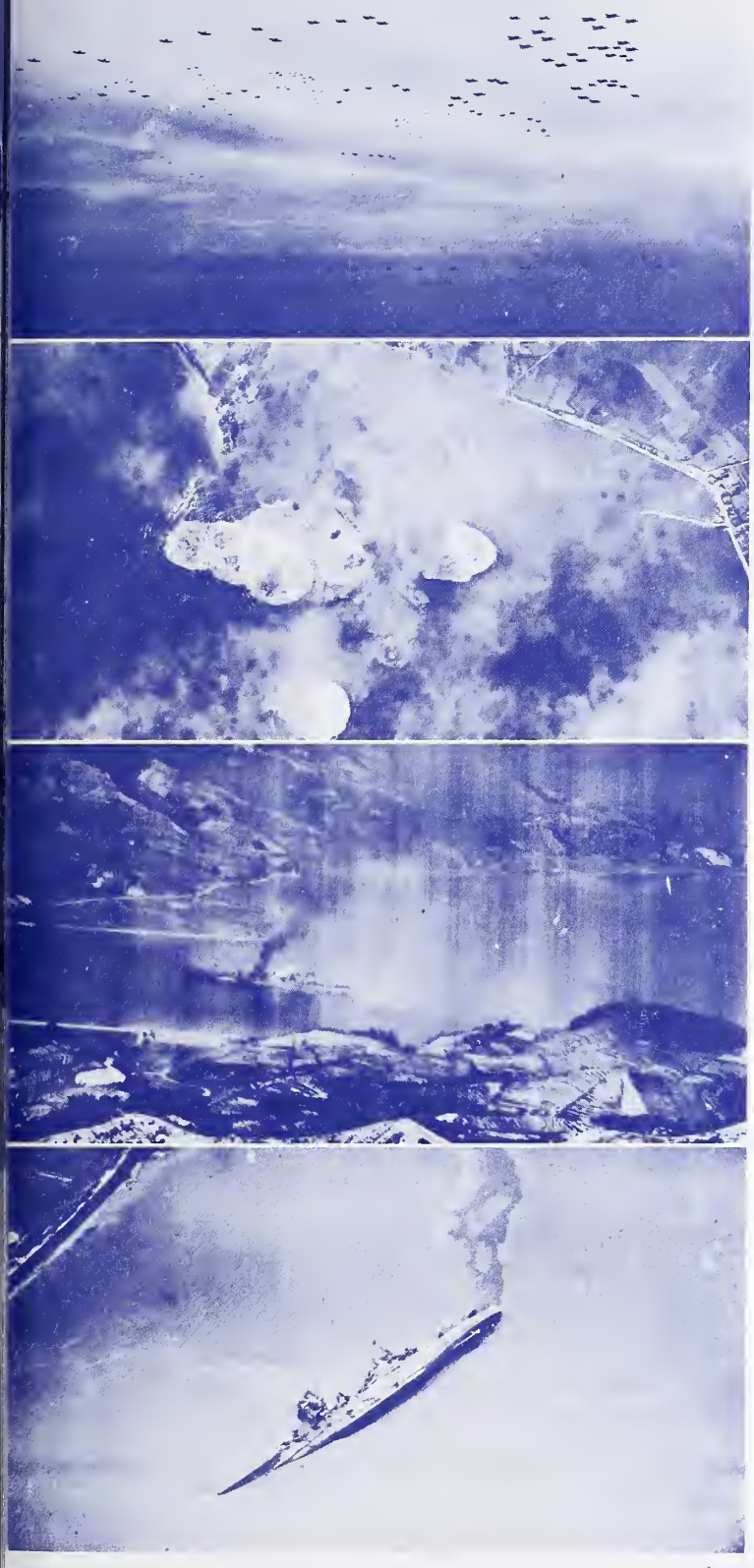
NAVAL AIR POWER



Murder's Row, USS WASP CV-18, USS YORKTOWN CV-10, USS HORNET CV-12, USS HANCOCK CV-19 in Ulithi. The aircraft that flew from the decks of these carriers. Above; left to right. TBF, F4U, SB2C, F6F.

By 1944 the great productive capacity of United States had produced a tremendous amount of munitions for war. Among these were a large number of carriers and supporting ships, hence the carrier task forces in the Pacific continued to grow in size and power. Two attack fleets were designated in the western Pacific. The Fifth Fleet, commanded by Admiral R. A. Spruance, contained fast carrier task force 58 under the leadership of Vice Admiral M. A. Mitscher. The Third Fleet was commanded by Admiral W. F. Halsey with fast carrier task force 38 guided by Vice Admiral J. S. McCain. Actually the ships of these two powerful fleets were one and the same and the number of the fleet to which they were attached changed only when the Fleet Commanders and their staff relieved one another. While one Commander was fighting this tremendous war making machine the other would be analyzing past battles and preparing for future moves forward. In this manner, almost constant pressure was placed on the Japanese. Much was learned from each action and at the end of the war the Third Fleet was the most powerful and destructive Fleet ever assembled on the high seas.

Demobilization following the Japanese surrender severely cut aviation along with other elements of the Navy. As after World War I, scientific and technological developments went forward at accelerated pace. Hence, though small, naval aviation rapidly advanced in effectiveness of material and future potential. Some impressive



Top. A strike group composed of more than 300 planes departs Task Force 38 to attack Japanese ships in Kure on island of Honshu. Photo 2—A Jap cruiser under attack by this strike. Photo 3—Cruiser burning amidships and at stern. Photo 4—Taken by the second strike group records the result of attack.

A16-3/(11) UNITED STATES PACIFIC FLEET lrb
Serial THIRD FLEET

00322

S-E-C-R-E-T
DECLASSIFIED

1st Endorsement on
C2CTF Secret ltr.
Serial 00242, dated
31 August 1945.

From: Commander THIRD Fleet.
To : Commander-in-Chief, United States Fleet.
Via : Commander-in-Chief, U. S. Pacific Fleet.

Subject: Action Report - Operations Against JAPAN, 2 July - 15 1945

1. Forwarded.

2. The operations of Task Force 38 during the period covering this report will ever be remembered in the annals of naval history. The naval power of the enemy was not only made impotent but was, for all intents and purposes, exterminated. An enemy air force hampered by lack of fuel, necessarily wide dispersal, and disorganized by continued defeat was hunted out and its effective striking power largely depleted. The shores of the enemy homeland for the first time felt the stinging blows of naval bombardment. In consequence the offensive of the great task force even abruptly ended on August 15, 1945 with the collapse of the enemy.

3. The near perfect defensive record of Task Force 38 during this period is most worthy of comment and commendation. Though termed defensive, such is more accurately described as offensive - defense. Employing enemy air field "blankets" together with concentrated attacks against enemy installations in nearly every circumstance reduced air reaction before it could be effectively organized. What relatively minor enemy air strength that did threaten the task force was in most every case quickly eliminated by intelligent stationing of pickets, effective stacking of combat air patrols, exceptional fighter direction and aggressive fighter tactics.

4. Noteworthy operational planning combined with excellent photography, meticulous pilot briefing and good pilot technique made possible the destruction of enemy air power on the ground, even though protected by wide dispersal and typical, effective oriental camouflage methods.

5. The destruction of the major enemy naval strength which was operable at the beginning of this offensive was a most difficult and trying task. The successful accomplishment of this task is most gratifying — the photographs, and consequent record, speak for themselves.

W.F. Halsey

W. F. Halsey

A16-3(2e-A) COMMANDER FIFTH FLEET 7 JUL 1945
UNITED STATES PACIFIC FLEET
FLAGSHIP OF THE COMMANDER

Serial: 00232

SECRET DECLASSIFIED

FIRST ENDORSEMENT to:
CTF 58 A16-3 Serial
00222, dated 18 June
1945.

From: Commander FIFTH Fleet.
To: Commander in Chief, United States Fleet.
Via: Commander in Chief, U.S. Pacific Fleet.

Subject: Report of Operations of Task Force FIFTY-EIGHT in Support of Landings at OKINAWA, 14 March through 28 May (East Longitude Dates), including Actions against KYUSHU, NANSEI SHOTO, Japanese Fleet at KURE, the YAMATO, and Operations in Direct Support of Landings at OKINAWA.

1. Forwarded.

2. This excellent report briefly and succinctly summarizes one of the most remarkable and most successful naval operations ever conducted. For the first time in history a fleet steamed to the threshold of an enemy homeland and, with its own air force embarked, stayed there, at sea, for a period of months until our own land and air forces were firmly established on the enemy's doorstep. Despite the most desperate and fanatical resistance that the Jap has yet conducted, not one ship of this force was sunk.

3. The enemy was decisively defeated; a large part of his air force was destroyed; his fleet was further decimated and he was prevented from reinforcing his forces on OKINAWA or interfering effectively with our operations there. It is no disparagement of the efforts of land based air which are now hastening the end to say that the carriers of Task Force 58 and their planes have made possible the victory which is now in sight.

R. A. Spruance

R. A. SPRUANCE.

NAVAL AVIATORS AWARDED THE CONGRESSIONAL MEDAL OF HONOR

Cdr. Richard N. Antrim, USN
Lt Col. Harold W. Bauer, USMC *
Naval Aviation Pilot Floyd Bennett, USN
Maj. Gregory Boyington, USMCR
Cdr. Richard E. Byrd, USN (Ret)
Lt Cdr. William M. Corry Jr., USN*
Capt. Jefferson J. DeBlanc, USMCR
Col. Merritt A. Edson, USMC
Capt. Henry T. Elrod, USMC*
Capt. Richard E. Fleming, USMCR*
Capt. Joseph J. Foss, USMCR
Capt. Robert E. Galer, USMC
Lt. Nathan G. Gordon, USNR
Lt. (jg) William E. Hall, USNR
Ens. Charles H. Hammann, USNRF
1st Lt. Robert M. Hanson, USMCR *
Lt. (jg) Thomas J. Hudner Jr., USN
Lt. (jg) John K. Koelsch, USN*
Cdr. David McCampbell, USN
Lt. Edward H. O'Hare, USN
Lt. John J. Powers, USN*
1st Lt. Christian F. Schilt, USMC
Maj. John L. Smith, USMC
1st Lt. James E. Swett, USMCR
2nd Lt. Ralph Talbot, USMC
Lt Cdr. Bruce A. Van Voorhis, USN*
1st Lt. Kenneth A. Walsh, USMC

Posthumously

steps were the introduction of jet aircraft, with their high takeoff and landing speeds, and their greater weight, which required longer and stronger carrier decks. Angled flight decks, that increased the usable area, and powerful steam catapults were designed for new carriers and included in the modernization of World War II carriers. Helicopters replaced the float planes which had served so long on board battleships and cruisers. Flight at unprecedented heights and speeds brought forth new flight clothing and automatic ejection equipment for the safety of pilots. Advances in ordnance, navigational gear, and electronic sighting devices changed tactical doctrine. The dramatic launch from a carrier at sea of guided missiles, their swift development for planes and the adaption of nuclear warheads to naval weapons presaged the most momentous change in naval air development.

However, the fleet was reduced too much for the widespread problems facing it. The post-war period brought a succession of incidents throughout the world requiring mobile, flexible and self contained power to safeguard freedom.

The five years from 1945 to 1950 were a constant succession of crises. In Greece, in the Middle East, in Iran, in North Africa, in China, in Oceania, and South Asia, almost everywhere the seas touched seapower was needed to bring U. S. strength and aid to a seething world. The Navy stretched almost to a breaking point to set up a Mediterranean force (which it has had to maintain through every generation from the time of the Barbary Wars), a token Middle East force, a far East Fleet, a Pacific Fleet, an Atlantic Fleet and many special duties like the Bikini atomic tests and Antarctica exploration. It had too little of everything, especially of aircraft carriers which with their high speed planes add markedly to instant readiness to act anywhere, to speed and weight of concentration and to most of the other ancient superiorities of sea based strength.

Yet as world duties grew, aircraft carriers along with the rest of the fleet were steadily reduced in numbers as these five fateful years approached the next cataclysm.

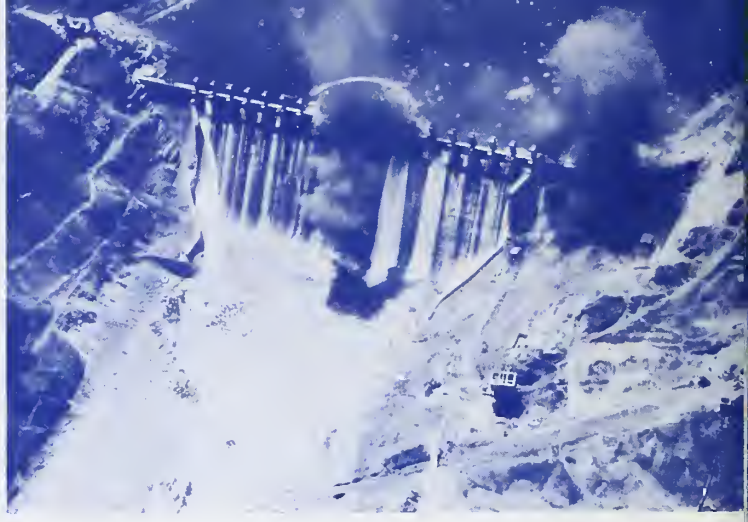
The crisis of access to Berlin precipitated in 1948–49 did not change this trend though naval aircraft played a prominent role in the historic airlift, and without shipping and control of the sea there would have been little to lift, no fuel for the planes, and no hope for the city.

Then on June 25, 1950 the communist North Korean army poured across the 38th Parallel into South Korea. Reacting to this calculated aggression, President Truman ordered U. S. military support of the South Korean defenders. Now the need was indeed desperate for an adequate Navy and above all its air elements. Naval forces already in the Western Pacific went into action immediately to blockade the Korean coast, and launched air and surface strikes against military targets.

Air Group Five from USS VALLEY FORGE blasted railroad yards and bridges in Pyongyang, capital of North Korea. Before a month had passed, two fast carriers and two escort carriers, the latter with Marine fighter squadrons on board, were actively engaged. The heroic U. S. Army and Korean patriots could not have hung on, could not have received reinforcements of U. S. Marines at a critical hour, and could not have crushed the invaders after the classic use of seapower in the amphibious end run at Inchon without effective naval employment. Naval air was especially important in this bitter war and built up rapidly. In less than a year, naval air strength in Korea was equal to any it reached in the course of the three year conflict.

LEFT—The Truculent Turtle that set the remarkable distance record in 1946 of 11,235.6 miles not surpassed until the 1960s was the first of seven generations of P-2 Neptunes which for eighteen years were the mainstay of long range ASW. RIGHT—The P-3 Orion is the replacement for the P-2s. Capable of patrolling effectively almost twice the area of its predecessor the Orion is a welcome addition to the fleet.

One of the most versatile war machines ever built, AD Skyraider can be used as dive, torpedo, patrol bomber and once load is dropped becomes a capable fighter. Displays flexibility and versatility to accomplish many different missions.



Aerial torpedoes dropped by AD Skyraiders smash floodgates of Hwachon Dam. Conventional bombing attacks had failed but torpedoes succeeded in releasing water into the Pukhan River effectively slowing a Communist Army advance.

Jet aircraft were proven as fighters and fighter bombers. Naval aircraft worked around the clock and proved invaluable in many diverse ways; providing air cover for the amphibious invasion of Inchon and the evacuation of Hungnam, destroying key industrial installations like hydro-electric power plants, cutting lines of communications such as the Yalu River bridges and railroad lines, mine spotting and close support of troops in battle. Helicopters were used increasingly for speedy evacuation of wounded, rescuing downed pilots from behind enemy lines, artillery spotting, and other observation work. From the opening of hostilities until the end of the war, Navy and Marine Corps aircraft flew more than one third of all the combat sorties flown by all American air forces in Korea.

In the years after the uneasy Korean truce, the international situation has never relaxed for long. Man advances into the future at space age speed that releases forces of change and unrest elsewhere. United States' traditional ability to deploy naval forces in troubled areas of the world acquired new importance as a safeguard of peace throughout the world.

The far flung deployment and mobility of the Navy that have made it a leading force in keeping an uneasy peace have also made it repeatedly available for missions of mercy throughout the world. In these missions naval aircraft, flying from ships close to disaster, have played a key role in relief and medical assistance to numerous areas plagued by floods, earthquakes or other natural disasters. Men in many lands have blessed the U. S. Navy and the United States for the unselfish aid.

Meanwhile, the weapons and tactics of naval aviation were constantly reappraised; modifications to incorporate advanced designs were adopted. Confronted by the menace of the Soviets large submarine fleet, the U. S. Navy laid increased emphasis on anti-submarine warfare. From 1953

A F4U-5, improved model of World War II, Corsair, received last minute check of ordnance before departing on mission in Korea. It carries rockets, bombs, napalm filled drop tank and 20 millimeter cannons.

The Korean War was the combat test for jets like the F9F. They were used both as fighters and fighter bombers.

USS PRINCETON with assault helicopters spotted on deck.

US Marines with full combat pack prepare to board assault helicopters for a vertical envelopment mission.

Marines unload a 105 mm gun from large CH-37C assault helicopter.

U.S. Navy Hunter/Killer anti-submarine warfare group. Built around an ASW aircraft carrier with an ASW air group embarked, the group contains escort destroyers, killer submarines, and naval support units. Land and sea based long range aircraft also often operate with the group. These ASW groups maintain surveillance around the clock, around the calendar, over a large area of the world's oceans.

F-8E Crusader armed with Sidewinders, an air to air missile. The boost/glide missile weighs 155 pounds and is guided to target by a heat seeking device.

Added to the Navy's growing list of missiles is "SHRIKE," and air to surface homing missile. The A-4 Skyhawk is shown firing the missile during tests at U.S. Naval Ordnance Test Station, China Lake, California.

on, a number of attack carriers were redesignated CVS and assigned anti-submarine missions. New hunter/killer task groups of special air, surface and sub-surface units were established in 1958, providing a means of improving anti-submarine tactics. Anti-submarine warfare was reinstated as the primary mission of patrol aviation and the Naval Air Reserve.

Four 60,000 ton carriers, FORRESTAL, SARATOGA, RANGER, and INDEPENDENCE joined the fleet in the 1950s, KITTY HAWK and CONSTELLATION in 1961, the nuclear powered ENTERPRISE in 1962, and the AMERICA in 1965. The JOHN F. KENNEDY will follow in 1968 and the nuclear powered NIMITZ in 1972. Optical landing systems were installed on all carriers to increase safety and flexibility. As operational aircraft consistently broke the sound barrier it became necessary to replace the conventional guns with missiles in order to fight the aircraft at high altitudes and supersonic speeds. As electronic advances have relieved the pilot of practically all duties except flying the aircraft, latest models are referred to as 'weapons systems'. The A-5 Vigilante is the first to be called the Navy Attack Weapons Systems.

The revolution that took warfare into the skies, also brought new dimensions to sea power as the Navy integrated aviation with the fleet, laying a foundation for the stirring age of space.

This achievement is a continuation of a rich heritage, for the Navy has long been a leader in scientific and technological development. Seagoing officers, besides being skilled shiphandlers and fighting men, have made outstanding contributions to exploration, medical science, astronomy, steam engineering, the ironclad warship, the screw propeller, Diesel power, computing ma-

The F-4 Phantom II currently has broken some 17 world records. This rugged fighter has flown in excess of 1600 MPH and has climbed to 98,430 feet in record time. Its versatility is shown in this picture in which it is armed for an attack mission.

A-5 Vigilante can fly twice the speed of sound and at altitudes above 90,000 feet. It will operate from carriers as well as land bases.

U.S. Navy Wright B-1 used in early tests of airborne radio.

Ensign Michelson at work on his experiment to determine velocity of light.

SOME EARLY FOUNDATION FOR SPACE EXPLORATION

1794–1802—Besides his outstanding leadership in peace and war, Commodore Thomas Truxtun's avid inquiry into maritime science resulted in books on navigation, signals, warships rigging, and duties of naval officers. Nathaniel Bowditch credited Truxtun with "the knowledge we possess of the Gulf Stream."

1808—Dr. Edward Cuthush, USN, started a tradition of distinguished scientific research which continues in today's Navy Medical Corps, when he published the earliest known scientific hook hy a Navy Medical officer. Included in his work are directions for the preparation of certain food concentrates for long sea voyages.

1833–1840—Commander Matthew Calbraith Perry, USN, noted for his introduction of optic principles and his leadership in early steam navigation, long hefore his fame in opening Japan, organized the United States Lyceum at New York Navy Yard "to promote the diffusion of knowledge among naval officers."

1836–1861—Matthew Fontaine Maury, USN, known as "pathfinder of the seas," most world renowned American in the 1850's applied scientific principles to navigation, astronomy, and oceanography. His findings are a basis for modern scientific work in these fields.

1838–1842—Continuous ohservations of moon culminations, occulations, and eclipses made at the Depot of Charts and Instruments hy Lieutenant James Melville Gilliss, USN, in support of thc Wilkes expedition, laid the foundation for the formal establishment of the Naval Ohservatory.

1862—Secretary of the Navy Gideon Wells directed Captain Charles Henry Davis, to form the Navy Department's Permanent Commission, an organization "to which all suhjects of scientific character on which the Government may require information he referred."

1878–1879—While an instructor at the Naval Academy, where he had recently graduated, and with equipment constructed hy himself, Ensign Alhert A. Michelson, USN, measured the velocity of light with high precision, beginning his fame as one of the world's leading physicists.

1888—Seven years hefore Marconi's success with radio, Lieutenant Bradley Fiske, USN, experimented with wireless communication ahoard ship and was granted a patent for radio-controlled torpedoes. The hasic principle *of these torpedoes is used in* present-day guided missiles and space flights.

1912—The first test of airborne radio was conducted near Annapolis, Md., when an aircraft flown by LT John Rodgers, USN, transmitted the letter "D" to the destroyer USS Stringham, over a mile away.

1913—The Sperry gyroscopic stabilizer, an early ancestor of the auto pilot and missile guidance systems, was flight tested in the C-2 flying boat hy LTJG P. N. L. Bellinger, USN, at Hammondsport, N.Y.

1914—Fire control computers, the "mechanical hrain" predecessor of electronic computers important in space flight were perfected for accurate long range fire hy Navy's guns at moving targets.

1917—The Navy's first guided-missile effort hegan when the Navy Consulting Board recommended to the Secretary of the Navy that money be apportioned to carry on experimental work with automatically controlled drone aircraft carrying high explosives.

1922—In the first discovery of the radar principle, two Navy scientists at NRL ohserved interruptions of high frequency radio communications by a ship passing on the Anacostia River between the transmitter and receiver. They proposed use of this phenomenon for detecting ships in darkness and fog.

1934—Steadily progressing in development of the world's first radar, Naval Research Laboratory scientists A. H. Taylor and L. C. Young ohserved the first aircraft radar echoes. The target was a single seat "wood and fabric" airplane at 1 mile.

1938—A test of a regenerative type rocket motor designed hy Midshipman Robert C. Truax, an inventive student at the Naval Academy, indicated the validity of Truax's design, which was later recognized as an important step on the road to practical liquid-fuel rocket engines.

Matthew Fontaine Maury, famed for his research in navigation and oceanography.

SOME RECENT NAVY CONTRIBUTIONS TO SPACE

1941 (31 May)—A project to develop liquid propellant rockets, pulsejets, and underwater propulsion devices began at the Engineering Experiment Station Annapolis.

1941—Navy supported research develops air driven gyro for Draper Sight fire control of automatic AA Gun. Descendants of this gyro function in all space vehicles.

1944—Monopulse radar, now the basis for all modern tracking and missile control radars, was developed at the Naval Research Laboratory, Anacostia, D.C.

1944 (3 Sept.)—First combat employment of a missile guided by radio and television took place when a Navy PB4Y DRONE attacked a German airfield on Helgoland Island in the North Sea.

1945 (3 Oct.)—First formal studies of earth satellite vehicles financed by government funds started when the Chief of the Navy Bureau of Aeronautics established a Committee for "Evaluating the Feasibility of Space Rocketry."

1946—Navy research scientists, pioneers in the field of rocket astronomy, began the development of the high altitude probe rocket VIKING which was later modified to provide the first stage for VANGUARD.

1951—Installation of the 50-foot radio telescope at the Naval Research Laboratory was a pioneering step in the development of the relatively new science of radio astronomy.

1953—First physiological data telemetered by electronic means from a pilot in an aircraft to the ground was collected by the Naval Medical Research Institute, Bethesda, Md.

1954 (25 June)—The Office of Naval Research proposed the joint Navy-Army development of an earth satellite known as Project Orbiter. Although the Navy later withdrew in favor of Project Vanguard, this proposal led to the first U.S. satellite, Explorer I.

1955 (27 Sept.)—The Chief of Naval Research was selected to manage Project Vanguard, a plan to launch an earth satellite during the International Geophysical Year.

1957 (5 Oct.)—A radio satellite tracking net called Minitrack developed by the Naval Research Laboratory became operational. This complex network, with stations extending from Maine to Chile, was designed to track the Vanguard satellites, and is in use today.

1958 (17 Mar.)—The Navy entered the space age by launching into orbit a test sphere. The firing was designed to test the Vanguard system of earth satellites.

1958 (16 June)—The Navy-managed Pacific Missile Range was established to support guided missile, satellite, and space vehicle research.

1958 (8 Sept.)—In one of a series of tests a Naval Aviator, wearing a Navy developed full-pressure suit, completed a 72-hour simulated flight, during which he was subjected to simulated altitudes of 139,000 feet. NASA later selected this suit for the Project Mercury Astronauts.

1959 (13 Mar.)—During one of about 140 firings between 1948–1966 of the Navy-developed Aerobee and Aerobee-Hi research rockets, the first ultraviolet pictures of the sun were taken by the Navy Research Laboratory.

1960 (28 Jan.)—As a result of moon reflection techniques demonstrated as early as 1951, the NRL transmitted a radio photograph from Hawaii to Washington, D.C., via the moon.

1960 (13 Apr.)—The Navy's Transit IB navigation satellite was placed into orbit. The Transit system transmits navigational information to ships with an accuracy of one tenth of a mile.
1960 (19 Apr.)—The U.S. Naval Space Surveillance Facility was established at Dahlgren, Va. This was the Navy's first operational space organization. Its mission is to detect foreign satellites crossing our territory. (Done experimentally since 1958.)
1960 (22 June)—The first U.S. orbit of multiple satellites was achieved when the Navy's Solrad 1 separated from Transit 2A when in orbit.
1960 (20 July)—The Submariners joined the space age with first successful firing of a Polaris missile from submarine GEORGE WASHINGTON.
1961 (28 Mar.)—The Navy began the training of Mercury astronauts in such subjects as water survival and simulated mission profiles. The last project used the Navy's giant centrifuge at the Aviation Acceleration Laboratory, Johnsville, Pa.
1961 (4 May)—In the last of a series of manned ballon flights, Strato-Lab V achieved a record breaking altitude of 113,773 feet. The data collected were invaluable in solving problems faced by the astronauts.
1961 (5 May)—Commander Alan B. Shepard, Jr., USN, was the first American in space. After a suborbital flight of 320 miles he and his capsule, Freedom 7, were recovered by helicopters from the carrier LAKE CHAMPLAIN.
1961 (24 Oct.)—Project HYDRA—An Aerobee liquid-fuel rocket was fired from the water at Point Mugu in a test which demonstrated new possibilities for launching rockets from the open sea.
1962—The first three Americans to orbit the earth were Naval Aviators, Lieutenant Colonel John H. Glenn, Lieutenant Commander M. S. Carpenter, and Commander W. M. Schirra.
1963 (12 Nov.)—The astronauts commenced a helicopter familiarization program at the Navy's Ellyson Field as part of their training for lunar landings.
1964 (28 May)—NRL's missile and space research radar with a 150-foot steerable antenna became fully operational. It determines radar-echo characteristics of missiles, satellites, and other space targets.
1965 (19 Apr.)—In a test to determine man's ability to live for long periods in space, eight Naval Aviators spent 34 days in sealed chambers at the Naval Aerospace Equipment Laboratory, Philadelphia.
1966 (15 Nov.)—The Gemini program came to an end when the WASP recovered her fifth space capsule, GEMINI XII. During the Mercury and Gemini missions the Navy provided over 340 ships and countless aircraft for recovery operations.
1967 (17 May)—Using instruments aboard an Aerobee, Naval Research Laboratory rocket-astronomers first detected X-rays emitted from at least one of the quasars, 1.5 billion light years away.

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chines, communications, radar, nuclear propulsion, atomic energy, and countless other advances.

Space operations now offer the Navy its newest and most exciting challenge. In the past it has long explored beyond earth in astronomy, navigation, communications, weather forecasting. The Navy looks upon this challenge with a keen interest stemming from its basic mission to control the sea for the safety of America and salvation of free men. Since the oceans and seas cover 71 percent of the surface of the earth, any space operation designed to control, observe, or influence activities on the earth's surface must be a major naval concern.

The Navy is especially interested in earth orbital space systems which directly support Naval operations relatively near the surface of the earth. One application of this new technology is the transit navigational satellite, a precise all-weather system that provides extremely accurate navigational data to our surface and subsurface forces in fair weather or foul. Another is the communications satellite giving continuous worldwide coverage to all our forces. Likewise, the Navy is intensely interested in weather satellites that improve the reliability of meteorological forecasts.

These are but the beginning steps of the precocious pioneers of space science. Athough the future of space programs expands unpredictably, the Navy is already studying possibilities of satellites to record ship traffic and aid in air-sea rescue operations. Another Naval experiment has been with the ANNA geodetic satellite, which can solve many geophysical problems of the past, present, and future by measuring global geodetic characteristics.

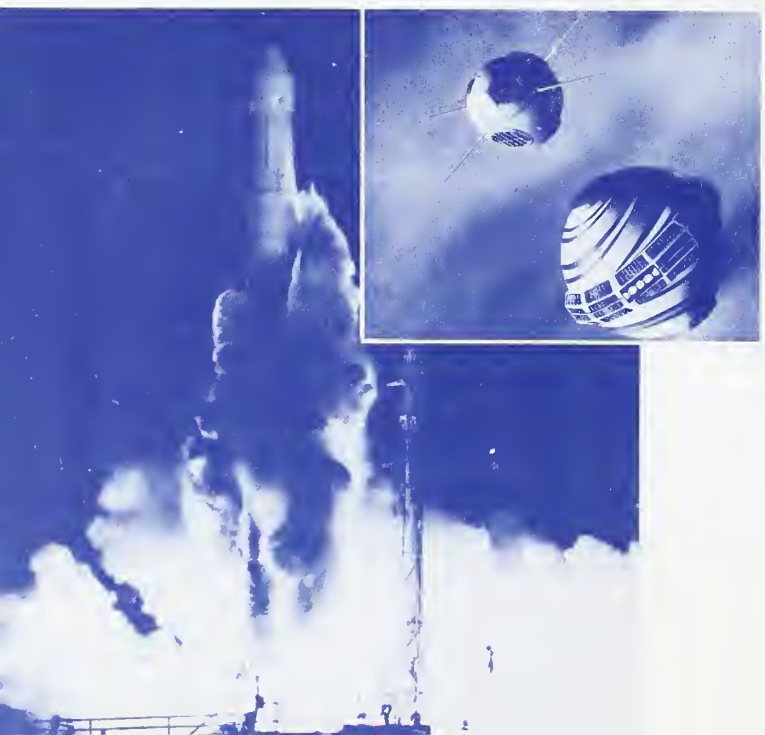
When the launching of earth satellites became practical, many military planners recognized their potential for gathering information of military value. Thus it became important for the United States to detect satellites silently crossing our territory. One of the first steps to counter this threat is the Naval Space Surveillance System developed on an emergency basis by the Naval Research Laboratory in 1958. This complex net of transmitting and receiving stations stretching across the southern United States maintains up-to-date orbit data for hundreds of objects in space.

In addition to adapting space technology to military uses, the Navy is justly proud of its many contributions to the peaceful man-in-space

Four of first seven Astronauts were Naval Aviators. Left to right; LCDR W. M. Schirra, LT M. S. Carpenter, ADM A. A. Burke (holding model of MERCURY capsule), LT GEN V. J. McCaul, LCOL J. H. Glenn, LCDR A. B. Shepard (describing the action of the space vehicle).

Thor-Able missile lifts off the pad with TRANSIT 1A housed in the nose cone.

TRANSIT satellite and a solar radiation measurement satellite shortly after separation while in orbit. The TRANSIT system transmits navigation information to ships with an accuracy of one tenth of a mile.



program, which follows in the wake of the long naval record of contribution to peace.

Since the initiation of Project Mercury in October 1958, the Navy has applied its distinguished research facilities to help solve the many problems faced by the National Aeronautics and Space Administration. Naval Aviation Medicine has been required to provide Naval and Marine aviators with a means of withstanding extremely low atmospheric pressures, extremes of temperature, high acceleration and deceleration forces, and other psycho-physiological hazards of high-speed, high-altitude flights. Studies required to solve these problems have contributed and shall continue to contribute to the many human factors problems posed by manned space flights. The astronauts' pressure suits, portable air conditioning unit, biosensors, and individually fitted couches and restraint harnesses are some of the equipment items developed by the Navy. The recovery systems use parachutes embodying the basic design of the Navy's sky sail parachutes. In addition to equipment, the Navy also contributed to the training of the Astronauts. The preparation of these airmen for their adventure in space has ranged from simulated mission profiles in the Navy's giant centrifuge at Johnsville, Pa., to survival and helicopter training at Pensacola, Fla.

The Navy's operational skills have also contributed to the space program itself. The recovery of capsules by our forces afloat, and the Navy's responsibility for the safe recovery of all the astronauts of Projects Mercury and Gemini, illustrate the advantage of using the sea as the landing platform for space vehicles. The fact that over 340 warships and countless Naval aircraft have served in recovery operations for the manned flights alone, demonstrates the magnitude

of this responsibility.

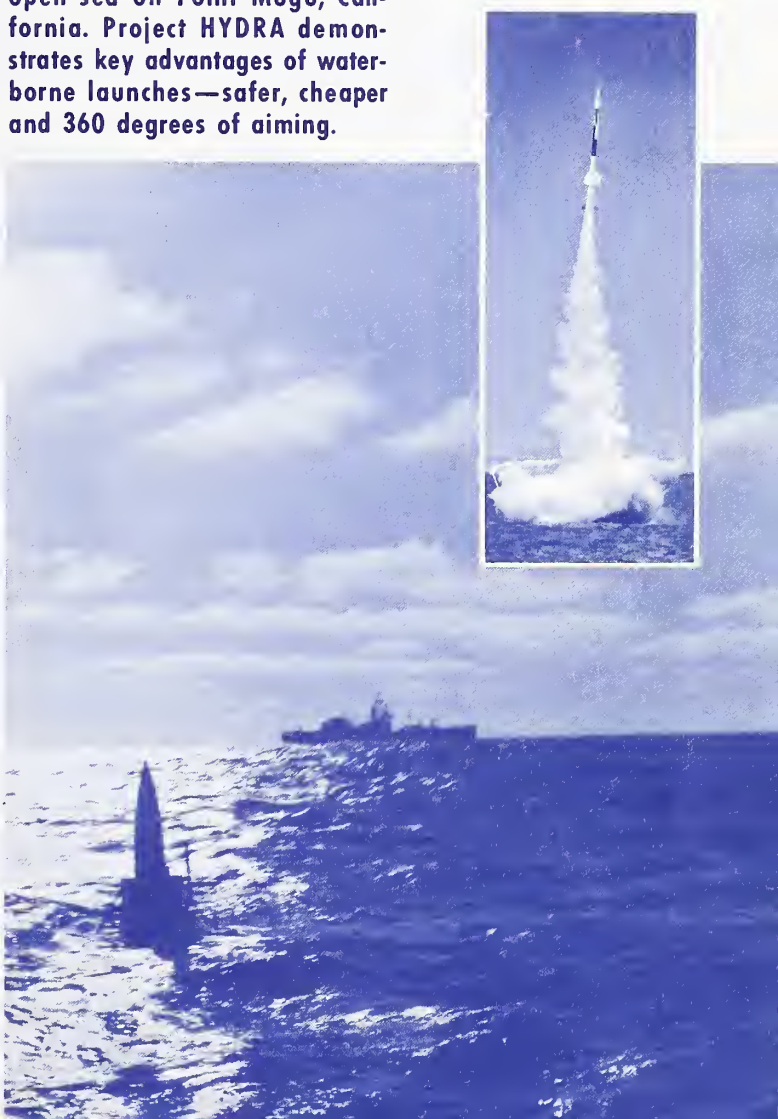
As the state of the art of rocketry progresses and as rockets increase in size—some are envisioned to be as large as destroyers—the many advantages of launching these giants from the sea are more and more under investigation. The Navy, through Project HYDRA, is proving that missiles of all sizes can be launched from the sea without complicated and expensive launching equipment. The sea is a self-healing launch pad, and the cushioning of the water, plus the ocean's space provides extra safety in the event of an explosion. This is especially significant if nuclear power replaces chemical propellants in future vehicles. Furthermore, favorable—and secret—positions may be chosen in the vastness of the sea, allowing any desired orbital path or azimuth with full security and without danger to land areas.

The American space program requires the integrated effort of all the scientific talent, military and civilian, that can be brought to bear by our nation. As it has through all stages of America's scientific development, the Navy is contributing its resources, its human skills, and its unique operational abilities to the advancement of knowledge. The Navy's role in space is essentially a natural outgrowth of its historic mission to launch power and resist aggression from the sea.

The integration of air into sea power has brought vast and growing benefits to the United States. As the space program develops these benefits are certain to grow, for the advantage of operating freely on and from the sea affects our world position in peace as well as in war. The restless tide of the sea in the story of America will continue to flood and the part of the air above the sea, controlled by Naval Aviation, will continue to be vital.

Astronauts of Gemini 9 wave to crew of approaching USS WASP. The Navy has provided over 340 ships for Mercury and Gemini recoveries.

HYDRA-IRIS is launched from the open sea off Point Mugu, California. Project HYDRA demonstrates key advantages of waterborne launches—safer, cheaper and 360 degrees of aiming.



1. 1946 A U.S. Novy force, including the corrier FRANKLIN D. ROOSEVELT, visited the port of Athens to bolster the government of Greece ond to check communism. The Greek Foreign Minister later soid: ". . . The Seo stonds for freedom of every humon soul; to us it stonds for life itself."
2. 1948-49 During the Berlin Airlift, o convincing proof of the volue of firmness in mointoining rights, 24 Novol plones took port, flying 45,990 hours ond carrying 129,989 tons of supplies to the beseiged city. The surfoce Navy insured the tronsport to Europe of enormous quontities of the supplies ond the fuel for the oirlift.
3. 1950-55 Lorge novol forces projected mossed ollied strength overseos to sustoin South Koreo, mointoin control of the seos for ossoult or retirement, provide powerful air ond gunfire bombardment ond unrestricted logistic support, mobility, speed, ond flexibility in combined operotions—thus containing the war and ensuring peoce.
4. 1954 United Stotes Novy provided o "Possoge to Freedom" for over 300,000 refugees from North Vietnom to the south. To notions of the Pocific, the 7th Fleet stonds for hope ond liberty.
5. 1955 At the request of the Republic of China units of the SEVENTH FLEET evocuoted troops, civilions, ond tons of material from the Tochen Islonds off the Chino mainland. The impressive power of the fleet discouraged communist interference.
6. 1956 When the Suez-Middle East Crisis become critical SIXTH FLEET ships evocuoted Americon ond allied notionols. An evocuee sofe on boord wrote: ". . . We never reolized how much the Flog meont to us until we saw it on the sterns of the landing croft."
7. 1957 In late April and May 1957, the SIXTH FLEET deployed in the Eastern Mediterronean to support the regime of Jordan's King Hussein and avert World disaster. "Jordan . . . hos been soved for Western Civilization by Bedouin Knives ond the SIXTH FLEET."
8. 1958 Ever ready with men, guns and planes the SIXTH FLEET at the request of the Lebanese government, londed its 1,800 Marines on o beoch near Beirut, with ship batteries troined out ond carrier plones overheod. "In the powerful grey diplomots of the SIXTH FLEET, we see the guorontee of small peoples' independence."

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Some recent examples of the U.S. Navy employed in keeping the peace, containing war, and guarding freedom since World War II.

(9) 1960 At the request of the governments of Guatemala and Nicaragua, surface and air units of the U.S. Navy took position to provide assistance if required. Their presence dissuaded the would-be invaders and another tense situation eased.

(10) 1960-61 Violence erupted in the Congo, Atlantic Fleet units including USS WASP (CVS-18) sped to the African coast transporting United Nations troops to the Congo, and emergency supplies to relieve starvation. The prompt action of the Navy backed UN mission prevented communist domination of this key African Nation.

(11) 1961 Supported by large task forces of the Navy, the United States began a long-term buildup of strength in South Vietnam to thwart aggression there.

(12) 1961 When the East German communist regime erected the Berlin Wall, the Navy activated Reserve ships and men to meet any crisis.

(13) 1962 On 24 October the air and surface units of the Atlantic Fleet established the Quarantine of Cuba to force withdrawal of Soviet ballistic missiles. Power afloat had provided the President with the power and flexibility necessary to keep the peace.

(14) 1963 The Dominican Republic's threatened invasion of Haiti brought out the U.S. Navy to the scene, prepared for any contingency. The crisis subsided.

(15) 1964 During the Zanzibar political crisis, USS MANLEY in order to guard American citizens and interests evacuated American and allied nationals. On her decks the sovereignty of America reached half around the world in support of freedom.

(16) 1964 On 4 August USS MADDOX and USS TURNER JOY destroyed attacking North Vietnamese PT boats in Gulf of Tonkin. On 5 August SEVENTH FLEET carrier aircraft from USS TICONDEROGA and USS CONSTELLATION struck North Vietnamese bases destroying a number of PT boats in retaliation for unprovoked attacks on the U.S. Destroyers. Naval air has rapid reaction time, a long and powerful reach.

(17) 1965 As revolutionaries ran wild in the Dominican Republic units of the SECOND FLEET including BOXER landed Marines and Army forces in Santo Domingo to evacuate U.S. nationals, to help maintain law and order, and to block a communist coup.

(18) 1967 War broke again in the Middle East, the third time since World War II and furthering Soviet aims in that strategic area. The SIXTH FLEET exerted a strong, stabilizing force in an explosive situation.

(19) 1961-67 Based on the sea and its broad highways, the United States defends liberty in Southeast Asia. "The U.S. Navy", as has been written, continues to be "today's greatest power for peace."

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